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Geographic distribution of blood collections in Haiti before and after the 2010 earthquake

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Abstract

Background—The January 2010 Haiti earthquake destroyed the National Blood Transfusion Center and reduced monthly national blood collections by > 46%. Efforts to rapidly scale-up blood collections outside of the earthquake-affected region were investigated.

Study Design and Methods—Blood collection data for 2004–2014 from Haiti's 10 administrative departments were grouped into four regions: Northern, Central, Port-au-Prince and Southern. Analyses compared regional collection totals during the study period.

Results—Collections in Port-au-Prince accounted for 52% of Haiti's blood supply in 2009, but fell 96% in February 2010. Haiti subsequently increased blood collections in the North, Central and Southern regions to compensate. By May 2010, national blood collections were only 10·9% lower than in May 2009, with 70% of collections coming from outside of Port-au-Prince. By 2013 national collections (27 478 units) had surpassed 2009 levels by 30%, and Port-au-Prince collections had recovered (from 11 074 units in 2009 to 11 670 units in 2013).

Conclusion—Haiti's National Blood Safety Program managed a rapid expansion of collections outside of Port-au-Prince following the earthquake. Annual collections exceeded pre-earthquake levels by 2012 and continued rising annually. Increased regional collections provided a greater share of the national blood supply, reducing dependence on Port-au-Prince for collections.

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Contributors

JP conceived of the study idea. AB, AEJB and JP contributed to study design, literature search, data analysis and interpretation, preparation of figures and tables and writing. AEJB, EN, NPDJC and EP contributed to data collection.

Declaration of interests

We declare no competing interests.

Keywords

blood collection centre; blood collections; earthquake; Haiti; National Blood Safety Program; Port-au-Prince

Introduction

On January 12, 2010, a magnitude 7·0 earthquake struck the Republic of Haiti, the Caribbean nation that shares the island of Hispaniola with the Dominican Republic. The earthquake caused more than $7·9 billion in damage (i.e. 120 per cent of Haiti's gross domestic product) and dramatically increased existing challenges in a country that was already the poorest in the Western Hemisphere [1]. Casualty estimates from the earthquake exceeded 222 250 deaths, 300 000 injuries, and as many as 2·3 million people displaced [2], making it one of the deadliest natural disasters on record. The earthquake caused massive destruction in and around the densely populated capital city, Port-au-Prince, and in the southern part of the country. Eight hospitals were destroyed and 22 were seriously damaged [3]. The impact on Haiti's National Blood Safety Program (NBSP) was immediate and severe. The NBSP headquarters in Port-au-Prince was damaged, and four blood collection centres were completely destroyed, including the National Blood Transfusion Center (NBTC). Prior to the earthquake, the NBTC accounted for the majority of blood collected nationally and provided laboratory screening (i.e., HIV, hepatitis viruses B and C, HTLV and syphilis) for all donated blood units in Haiti. Donor recruitment, including Club 25 blood promotional activities, was directly affected by the disaster, as was the NBTC's training programme. Very little blood was available for transfusion in Haiti immediately following the disaster, largely due to the destruction of the NBTC and its capacity to collect, process, screen, store and distribute blood. International relief organizations initially imported thousands of blood units as the NBSP strategized its recovery, including the acceleration of mobile blood collections and the establishment of a temporary NBTC to resume laboratory screening [4].

Haiti's Ministry of Health (MSPP) created the NBSP in 2004 to co-ordinate and oversee blood collection, screening and distribution services provided by the Haitian Red Cross. NBSP has received funding and technical assistance from the U.S. President's Emergency Plan for AIDS Relief (PEPFAR) through the U.S. Centers for Disease Control and Prevention (CDC) since 2004 to strengthen the government's oversight capacity and increase the availability of safe blood for Haiti's 10·5 million inhabitants. During this period, the Haitian Red Cross also received substantial financial support from the Global Fund to Fight AIDS, TB and Malaria.

In the five years following the formation of the NBSP, blood collection rose by 144% (from 9000 units in 2004 to 22 000 units in 2009), and donations from voluntary, non-remunerated donors (VNRD) increased from 5% to 70% [5]. The NBSP hoped to reach the goal of 100% voluntary donations by 2010, but its efforts were seriously hampered by the earthquake.

This study was designed to evaluate post-earthquake blood collection levels and collection sites against pre-earthquake blood collection patterns. Specifically, the study documented

changes in the geographic distribution of blood collections in less-populated regions compared to the capital city, Port-au-Prince.

Materials and methods

We conducted a retrospective analysis of whole blood collection records using Haitian Red Cross data reported to the NBSP from 2004 to 2014. These data were derived from monthly Haitian Red Cross reports from each of the country's blood collection sites. The number of active collection sites ranged from 17 before the earthquake to 13 immediately following the 2010 disaster. A total of 16 sites were operational by September 2014. Data from collection sites in Haiti's 10 administrative departments were grouped into four regions (Fig. 1): Northern (Nord-Ouest, Nord and Nord-Est departments), Central (Artibonite and Centre departments), Port-au-Prince (Ouest department) and Southern (Grand'Anse, Nippes, Sud and Sud-Est departments). Descriptive statistics were calculated for each site to show changes in collections by sites over the 11-year study period. No sampling was performed; data from each site were considered to represent a census of all units collected.

Results

Blood collections more than doubled in Haiti during the five years after the formation of the NBSP, from approximately 9000 units in 2004 to 22 000 units in 2009. Whole blood collections in the Port-au-Prince region accounted for 83% of the national blood supply in 2004 and 52% by 2009 as regional collection capacity increased (Fig. 2). Whole blood collections in the Port-au-Prince region plummeted 96% in the month following the January 2010 earthquake compared to February of the previous year (February 2009: 936 units; February 2010: 41 units) (Table 1). Nationally, blood collections dropped 46% (February 2009: 1875 units; February 2010: 1008 units) in the month following the earthquake. Subsequently, monthly blood collections outside of the Port-au-Prince region increased rapidly compared to the prior year, rising 8·3% in March, 6·6% in April and 34% in May 2010. Whole blood collections in the Port-au-Prince region increased from 41 units in February 2010 to 477 units in May 2010. However, overall blood collections in the Port-au-Prince region were 75% lower between February and May 2010 (930 units) compared to the same period in 2009 (3714 units). By contrast, collections in the three regions outside of Port-au-Prince increased by 12·3% between February and May 2010 compared to the same period in 2009 (2009: 4189 units; 2010: 3729 units).

Annual nationwide blood collection totals increased steadily in Haiti over the 11-year study period, with the exception of the immediate post-earthquake years of 2010 and 2011 when annual collection totals fell 30% (14 919 units) and 7% (19 751 units), respectively, relative to 2009 (21 275 units) (Fig. 2). In the long run, nationwide collections tripled from 9307 units in 2004 to 28 867 units in 2014, when total collections surpassed 2009 preearthquake levels (21 275 units) by 36%. While collections in Port-au-Prince increased 68% from 2004 to 2014 (7758 units to 13 045 units), combined collections in the Northern, Central and Southern regions increased more than 10-fold from an aggregate total (all three regions) of 1549 units in 2004 to 15 822 units in 2014. Collections outside of Port-au-Prince also accounted for an increasing proportion of the national blood supply following the

earthquake, rising from 48% in 2009 to 55% in 2014. Substantial increases were observed in each of the individual regions outside of Port-au-Prince. For example, the Northern, Central and Southern regions (which account for approximately 20%, 21% and 23% of the national population, respectively) contributed 8%, 3% and 6% of the national blood supply in 2004. While overall population patterns remained stable in these three regions [6], the proportion of blood collected by each region increased to 19%, 23% and 13%, respectively, by 2014.

Discussion

The 2010 earthquake destroyed Haiti's NBTC along with three large blood collection centres in the Port-au-Prince region, where more than 50% of the national blood supply was collected. The NBTC was the country's busiest blood collection, processing and distribution site, and it was responsible for screening all of Haiti's blood donations for transfusion-transmissible pathogens. Despite the scale of loss, Haiti's NBSP successfully diversified blood collections from a broader geographic area and reduced the country's dependence on collections from Port-au-Prince. Haiti's blood collections are now much more geographically balanced (Fig. 1). The rapid recovery was driven by external donor-supported investments by NBSP in mobile blood collections, as well as mass media and person-to-person communications to mobilize blood donors in regions where blood collections had been limited before the earthquake [4]. The relocation and construction of three blood posts in areas outside of Port-au-Prince also contributed to increased collections and improved access to safe blood throughout Haiti.

Within 24 months of the disaster, annual blood collections exceeded pre-earthquake levels and continued to rise (Fig. 2). By 2014, collections were 36% higher than in 2009, the last complete calendar year before the earthquake. The importation of blood from other countries during the height of the crisis undoubtedly filled an urgent need in the national blood supply in 2010 and 2011. Unfortunately, it was not possible to quantify the number of units imported during the disaster response period. However, the expansion and diversification of blood collections in regions outside of Port-au-Prince, coupled with external donor-supported investments in rehabilitating or building blood collection posts and ongoing investments in a centrally co-ordinated National Blood Safety Program, contributed to the rapid rebound in national collections. In addition to contributing to Haiti's recovery from the 2010 earthquake, these changes should protect Haiti from future shocks (e.g., another earthquake or damage caused by seasonal hurricanes) to local blood collections.

Still, Haiti and the NBSP continue to face major challenges. While blood collections have recovered since the earthquake, total collections remain insufficient to meet the country's estimated annual demand for blood. According to NBSP, blood collections in 2014 were only able to meet 52% of the 55 000 units requested by healthcare facilities. Improving the blood supply is a priority for the NBSP, as is the establishment of better data systems to track blood ordering, availability and use statistics nationally. As more sophisticated medical care becomes available in Haiti – and as population demographics change – evidence from other countries suggests the demand for blood will only increase [7]. The earthquake also interrupted Haiti's progress towards a 100% VNRD blood supply. During the recovery phase, blood has been collected from a broader pool of donors. During 2014, VNRD

collections accounted for 52% of the national total [8], continuing a pattern of annual decreases in the percentage of VNRD collections since the earthquake (2010: 83·9% VNRD; 2011: 70·0% VNRD; 2012: 71·8% VNRD; 2013: 59·1% VNRD). Though the NBSP is working to reverse this trend and increase the percentage of VNRD blood collections, it is important to note that the percentage of blood collections reactive for HIV has not increased and remains below pre-earthquake levels [8].

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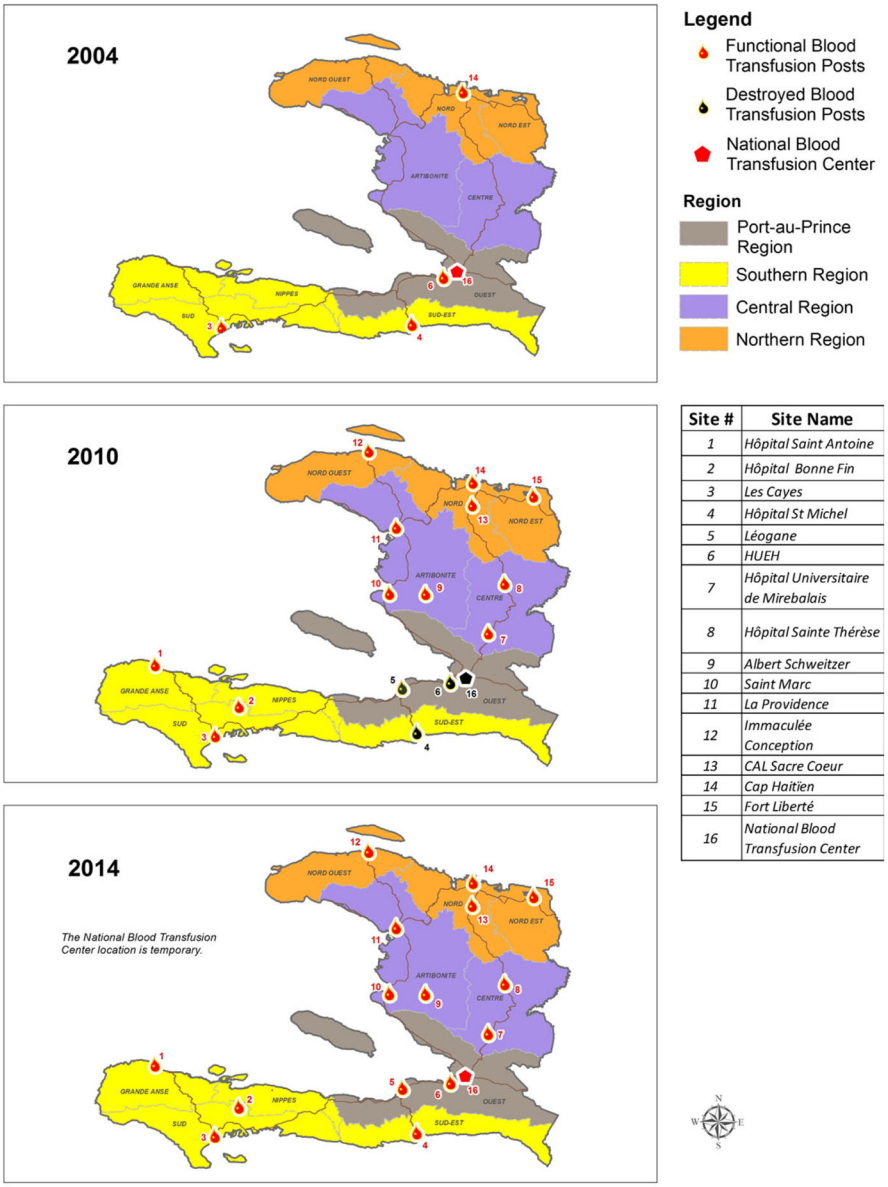

Site #	Site Name
1	Hôpital Saint Antoine
2	Hôpital Bonne Fin
3	Les Cayes
4	Hôpital St Michel
5	Léogane
6	HUEH
7	Hôpital Universitaire de Mirebalais
8	Hôpital Sainte Thérèse
9	Albert Schweitzer
10	Saint Marc
11	La Providence
12	Immaculée Conception
13	CAL Sacre Coeur
14	Cap Haitien
15	Fort Liberté
16	National Blood Transfusion Center

Fig. 1.

Haiti's ten administrative departments divided into four geographic regions (Northern, Central, Port-au-Prince and Southern) and pre-earthquake and post-earthquake blood collection sites. In 2004, Haiti's national blood network consists of two levels of facilities: one National Blood Transfusion Center and four blood collection sites or blood posts. The original facility that hosted the NBTC at Port-au-Prince was destroyed during 2010 earthquake. In 2014, the system for blood collection included 15 blood posts and one temporary NBTC.

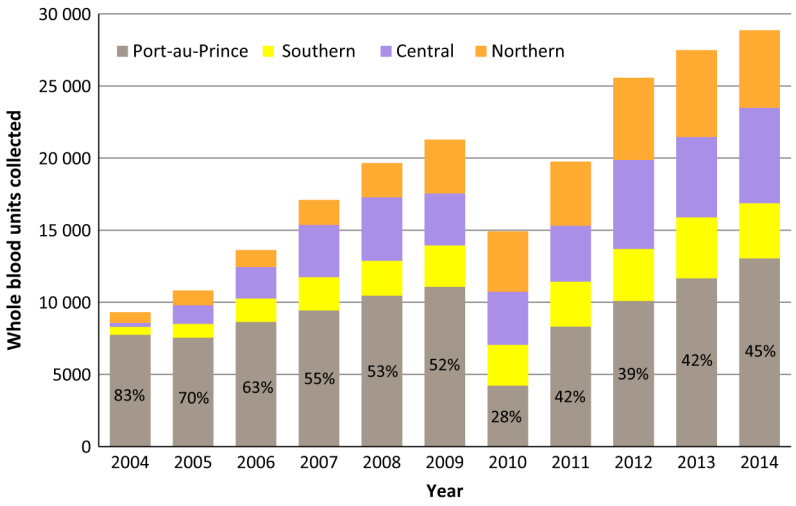

Fig. 2.

Regional and nationwide blood collection totals in Haiti, 2004–2014. Annual regional collections are subdivided by colour. Labels on the bars indicate the percentage of blood units collected in the Port-au-Prince region each year. Blood collection totals in 2004 were below 10 000 units, 83% of which were collected in Port-au-Prince. Blood collection totals increased each year before the steep decline in 2010 following the earthquake and have increased steadily since. By 2014, nearly 30 000 units were collected, with 45% of units collected in Port-au-Prince and 55% of units collected in the Southern, Central and Northern regions combined.

Table 1

Comparison of pre- and post-earthquake whole blood collection totals (February–May 2009 and February–May 2010)

	Whole blood units collected														
Region	**Feb 2009**	**Feb 2010**	**Change**	**Mar 2009**	**Mar 2010**	**Change**	**Apr 2009**	**Apr 2010**	**Change**	**May 2009**	**May 2010**	**Change**	**Feb–May 2009**	**Feb–May 2010**	**Change**
Port-au-Prince region	936	41	−95·6%	985	197	−80·0%	835	215	−74·3%	958	477	−50·2%	3714	930	−75·0%
North, Central and Southern regions combined	939	967	+3·0%	1048	1135	+8·3%	904	964	+6·6%	838	1123	+34·0%	3729	4189	+12·3%
All regions	1875	1008	−46·2%	2033	1332	−34·5%	1739	1179	−32·2%	1796	1600	−10·9%	7443	5119	−31·2%

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